# Study on investigation method of fracture distribution on the basis of data obtained at the Mizunami Underground Research Laboratory, central Japan.

*Eiji Sasao[1]

1. Tono Geoscience Center, Japan Atomic Energy Agency

Introduction

Fractures in the crystalline rock (e.g. granite) can act as the pathways for groundwater flow and mass transport. Therefore, understanding of the fracture distribution is an important subject for the disposal of high-level nuclear waste.

Japan Atomic Energy Agency performed geological investigation at the Mizunami Underground Research Laboratory, excavated in the Toki granite, to establish scientific and technological basis for geological disposal of high-level radioactive waste (Tsuruta and Sasao, 2016). In this study the author discusses the investigation method to understand fracture distribution effectively on the basis of the data obtained at the Mizunami Laboratory.

Method

In the ventilation shaft of the Laboratory with 5.3 meters in diameter after excavation, sketch of fracture distribution was performed at the scale of 1:20. Strike/dip and aperture of some fractures was described (Kawamoto et al., 2012, 2013). In this study, the author drew vertical scan lines (length of each lines is 316.2 meters) on the sketches along the north, south east and west walls of the shaft, and counts number of fractures intersected. Dip angle of fractures intersected was divided into low-angle (0-30 degree), intermediate-angle (31-60 degree), high-angle (61-90 degree) and no description.

Result and Discussion

Total number and frequency (number of fractures per one meter) of fractures intersected in each line are as follows; 432 and 1.37 (north wall), 434 and 1.37 (south wall), 470 and 1.49 (east wall), and 379 and 1.20 (west wall). On the fracture angle, ratio of low-, intermediate- and high angle fracture was 34-46 %, less than 10 % and 47-58 %, respectively.

As the result of this study, fracture frequency was varied even in a few meters distance. Coefficient of variation of fracture frequencies in four lines was calculated and was 4.3. It suggests inhomogeneity of fracture distribution. Coefficient of variation of fracture frequencies in each angle was 4.2 (low-angle), 7.9 (intermediate-angle) and 6.8 (high-angle). Variation was less in low-angle fracture. It indicates that low-angle fracture was easy to intersect because the scan line was vertical. Coefficient of variation of high-angle fracture was larger than that of low-angle fracture but lower than that of intermediate-angle fracture. This results from frequency of high-angle fracture is high (probably hither than that of low-angle fracture) even though the vertical scan line is hard to intersect high-angle fracture.

Coefficient of variation of fracture frequencies of 100 meters intervals of scan lines was reversely correlated with fracture frequency. This imply that coefficient of variation could be improved by intersection of more fractures by, for example, borehole investigation.

JAEA drilled borehole MIU-1 to 4 drilled at the Shoba-sama site. MIU-1 was declined with the angle of 60 degree and other three holes were vertical. Fracture frequency observed at the MIU-1 was obviously larger than those at other three holes. It caused by high probability of intersection of high-angle fracture in the declined borehole. It suggests that declined borehole directed to dominant direction of fracture is effective method to understand fracture distribution as mentioned in Ishibashi et al. (2014).

Reference

Ishibashi and Sasao, 2015; JAEA Reports, JAEA-Data/Code 2015-004, 8p.
Ishibashi et al., 2014; JpGU2014, HCG36-01.
Kawamoto et al., 2012; JAEA Reports, JAEA-Data/Code 2012-009, 47p.
Kawamoto et al., 2013; JAEA Reports, JAEA-Data/Code 2012-025, 32p.
Tsuruta and Sasao, 2016; J. Japan Soc. Eng. Geol., 56, 298-307.

Keywords: High-level radioactive waste, Geological disposal, Crystalline rock, Fracture

 